

Accelerator Systems Division Highlights for the Two Weeks Ending May 16, 2003

ASD/LANL: Warm Linac

HIGH-POWER RF (WBS 1.4.1.1)

Accomplishments This Week: (1) LANL shipped five tested SC linac klystrons, three SC klystron magnet assemblies, and one tested DTL Klystron to ORNL. (2) LANL site acceptance testing of DTL klystron S/N 10 is scheduled to start on 5/19. S/N 11 passed the factory acceptance tests this week. The next klystron, S/N 5, was scheduled to be factory acceptance tested the week of 6/9. This has been delayed to the first week in July due to delays in receiving a new cathode. (3) The first Thales SC linac klystron was installed in the LANL test stand; (4) CPI SC linac klystrons S/N 19 and S/N 21 completed factory acceptance tests. (5) The heat run data for SC linac transmitter S/N3 was reviewed and approved. The unit was shipped from Titan Pulsed Power systems to ORNL. Tests of S/N 4 are underway.

Concerns & Actions: (1) The 5-MW CCL RF system continues to be our biggest concern. Thales is still working on the redesign on the output waveguide section. One solution is to use an 1150 gas barrier from Mega. The first two gas barriers are due to Thales on 6/6 and the first two klystrons are scheduled for factory testing the week of 6/16, and the third klystron is scheduled for the week of 6/23. (2) CCL klystron S/N2 that lost vacuum at LANL is packaged and will be shipped next week. (3) Thales broke a SCL linac klystron, delaying the factory acceptance test that was to occur next week. The LANL procurement team is exploring options.

HIGH-VOLTAGE POWER CONDITIONING (WBS 1.4.1.2)

Accomplishments: The prototype high-voltage converter modulator (HVCN) was externally and internally inspected for damage following long run period in support of testing. No damage was observed. (2) Dynapower shipped production HVCN unit S/N 5 to ORNL. (3) Dan Borovina, Roy Przeklasa, Tom Hardek, John Sullard performed shifts at Dynapower for QA oversight. They supervised installation of junction boxes for electrical connections and software access. They inspected all current monitors needed for the testing. They supervised replacement IGBT switchplates, and found two bad IGBTs after being retested. Units S/N 6 and S/N 7 are now ready for testing. Joe Bradley will be at Dynapower next week to witness these tests. (4) Hardek used an old C/M rectifier assembly and a borescope borrowed from LANSCE to test a method of checking the quality of solder joints on the diodes on the cards in the C/M rectifier racks. This method was successful in checking the joints without disassembling the rectifier cassettes and will be recommended to ORNL as a way of checking the rectifier racks already installed. (5) Dynapower confirmed that they had completely inspected six rectifier assemblies for loose diode solder joints. Three of these assemblies will be sent out as a part of basket assembly 140kv-41764-001-004. The other three are being sent to ORNL as replacements for any bad rectifier assemblies in the already installed baskets. (6) The control rack, cable set and replacement header assemblies arrived at Dynapower. Borovina and Przeklasa completed integration of the fully functional control rack with the Dynapower C/M test stand. They also supervised re-wiring of the test stand and IGBT assemblies with the same fireproof wire that Dave Anderson is using at ORNL. (7) At PAC this week, Joe Bradley and Dave Anderson discussed formalized documentation of post-delivery mods to IGBT assemblies and other C/M parts as currently done at ORNL.

DRIFT-TUBE LINAC (WBS 1.4.2)

Accomplishments

Tank-3: (1) We supported the RF conditioning heat run which ran for about 24 hours at 1.5 MW, 30 Hz, and 1.2 ms pulsewidth. (2) Replacement waveguide parts are in the steel decladding/rough machining stage.

Tank-1: (1) Steve Ellis was at ORNL to support drift tube installation. All 59 DT's were installed (Fig.1). No significant problems were encountered. (2) Preparations are being made to complete post couplers on 5/27; we will try to move date up. (3) Slug tuners are ready for trimming.



Fig. 1: ORNL and LANL team in the SNS Front End Building after they installed the 59th (and final) Tank-1 drift tube.

Tank-4: (1) Group A & B drift tubes are scheduled for body to diverter brazing today; Group C & D drift tubes diverter to body braze preparation machining is complete; brazing is scheduled for 5/22. (2) Waveguide is under going pre-equatorial brazing mechanical inspection; brazing is scheduled for 5/20.

Tanks-5 & 6: (1) Drift tube bodies are undergoing water channel welding at Hanford. (2) Waveguide is under going pre-equatorial brazing mechanical inspection; brazing is scheduled for 5/20. (3) Stands are scheduled for shipment to ORNL on 5/30.

Tank-6: Drift tube bodies are undergoing water channel weld preparations at CMI. (2) Waveguide is scheduled for brazing of cooling channel plug joint on 5/19. (3) Stands are scheduled for shipment to ORNL on 5/30.

Tank-2: (1) Contract was issued to ESCO for fabrication of tank two bodies and sleeves; copper stock for bodies and sleeves has been shipped to ESCO. (2) Rough machining of waveguide is almost complete; it is scheduled to go to plating on 5/20 to plate pocket.

Dipole Drift Tubes: Magnet coil winding is scheduled to begin on 5/19. Core work is nearing completion. Molds are being prepared for trial impregnations. (2) Drift tube shell machining and brazing continues.

Concerns & Actions: ORNL noted that the EMD and BPM drift tubes are slightly harder to align; this may be due to a tighter fit in the 1" stem mounting hardware. LANL is making plans to kit and bag DT mount parts on a drift tube and tank basis.

PROJECT MANAGEMENT (WBS 1.4.6)

(1) PCR AS 03 009, "Dipole Magnet Procurement," was approved by LANL. This PCR transfers \$169K from LANL to ORNL/ASD for the procurement of DTL dipole magnets. In doing so, LANL will incur a \$141K negative cost variance which will be rolled up in our monthly reports to ORNL on WBS 1.4.2. (2) LANL approved the SNS Project Management Transition Plan between LANL and ORNL (SNS 102000000-PN0003 - R00).

ASD/JLAB: Cold Linac

ASD/BNL: Ring

Talks and posters were finalized for the HALO'03 conference.

Visitors Yuri Shatunov (BINP) and Izumi Sakai (KEK) were at BNL to meet with BNL/SNS management, engineers and designers.

Carbon Wire Scanner - Completed 12 assemblies (the complete order) of the HEBT wire scanner beam box.

Shipped HC #9 to SNS/OR on May 13th. This is our first left-hand assembly and our first position #8 half-cell. Work is underway on half-cells #10, 11 and 12.

The 1st article 27CD30 magnet (NETC) has been fully tested and approved for production by the AP Group. New England Technicoil will start winding the HEBT magnets for ASD early next week. All remaining production units (19) will be shipped directly to SNS/OR.

New England Technicoil delivered Chicane #2 to BNL this week. They are currently winding the first production 36CDM30 corrector magnet. Priorities have been set with NETC for a production run of four (4) 27CD30 magnets in support of ASD's HEBT installation plans. See Chicane #2 photos.



26Q40 (Stangenes) vendor production continues. We now have 3 of the 8 magnets in house; two more are in route; the last three magnets will be shipped in two weeks.

Tesla – first lot of eight magnets from the Ph II production contract have been shipped to BNL from England.

Alpha – the 1st article 26S26 high field sextupole has been shipped to BNL.

BINP (Budker) 5 magnets are in route to BNL.

Rancor has started work on the Outer Shield Assembly for the HEBT collimators.

Assembly work continues on the second set of (short) injection kicker magnets.

Design of the HEBT Momentum Dump is complete and the drawings are in Checking.

36Q85 rad hard quad: Winding of the fifth coil is in progress.

Controls

Coles Sibley and Ernest Williams of the ORNL Controls Team attended the PAC Conference in Portland OR and presented invited papers.

The controls team supported tuning of the RCCS and the attempted 48 hour “heat run” of full power into DTL3. Modifications had been made to allow resonance control to be based on the frequency error and tests were done to tune the resonance control loop in both frequency and temperature control modes. The tuning was greatly assisted by the ability to monitor all signals remotely from Los Alamos, where a team was assembled when needed to observe and advise. This worked quite well. The RCCS system proved to be functional, but not very robust. Many further improvements were suggested and will be implemented.

Also as a result of the 48 hour run, and at the request of the RF high power team, a new screen was developed at Los Alamos (within 24 hours of the request being made) to show better the rate of arcing as recorded by various arc detectors. That screen is shown below.



The Controls Team at Los Alamos prepared for a trip to ORNL next week to work on installation and testing of DTL1 and the D-Plate. Wiring for the D-Plate was checked. Software for the D-Plate RCCS and vacuum has been checked into the repository at ORNL. The video hardware was shipped from LANL to ORNL. Arrangements were made at ORNL to test DTL1 power supply controls next week.

Some minor changes were made to the Personnel Protection System (PPS) Phase 0.0 (Front End equipment including the 65 KV, Plasma RF, MEBT RF, and RFQ) hardware and PLC software to support conditioning of DTL3. Integration testing is 75% complete. Plans are to certify the modified system for a short run prior to the transition to Phase 0.4. Some of the wiring changes for PPS Phase 0.4 (Front End equipment, DTL1 and DTL3) have been completed and PLC programs and EPICS screens have been generated. Integration testing is 50% complete. The remainder of the wiring and testing will be completed after the DTL3 system is decommissioned. Wiring pulls for PPS Phase 1.0 (entire Linac) are continuing from the remote PLC racks to the field devices.

Nine of ten production Chipmunks have been processed through the SNS calibration procedure and three through the ORNL RICL (gamma calibration) procedure. All nine will be completed next week and an order has been placed

for the next 10. Next week, our Chipmunk vendor will start testing two prototype Chipmunks using alternative (commercially available) FETs. A contract has been placed with the Chipmunk vendor for repair services.

System	Controls Engineer	System Engineer	3:00am Phone Call Items	FSD (1) reviewed & delivered to Ernest	PLC & EPICS code in CVS	PLC & EPICS code at site	Archive data rcv'd from Sys Eng	Archiver File Complete	Alarm Setpoints received from Sys Eng	Alarm Setpoints defined & in EPICS database	Alarm Handler Config files to Yuri	Alarm Handler Config files at site (2)	Test Plan from Controls Engineer to Sys Engr & Eugene	Test Plan from System Engineer to Eugene	Overview screens linked in FE & Linac Maps (3)
CF	Cleaves	J.Cleaves	Done	Done	Done	Done		Done		Done	Done	Done	Done		Done
BLM	Larry Hoff	S. Assadi	Done	Drafted		Done				Done	Done			in progress	
RF Reference Line	Pillar	C.Pillar		Done											
HPRF	Pam Gurd	M.McCarthy		Done	Done	Done		Done		Done	Done	Done	Done	in progress	Done
MPS	Sibley	C.Sibley		Done	Done					Done			Done	Done	Done
Timing	Thompson	D.Thompson		Done	Done	Done							Done	Done	Done
Vacuum	Tang	P.Ladd			Done	Done									Done
RCCS	Tang	M.Ferguson			Done	Done									Done
DT Thermocouples	Sibley	S.Fisher			Done	Done									Done
Magnet PS	Munro	K.Rust	Done	Done	Done	Done								Done	Done
D-Plate Emittance	Nypaver	S. Assadi			Done	Done				Done	Done	Done	Done		Done
D-Plate Actuator	Tang	D.Purcell													
PPS	Stone	B.Stone												in progress	
LLRF	Lionberger	M.Champion			Done	Done		Done			Done	Done		in progress	
IOC Operations	Lionberger	C.Lionberger		Drafted	Done	Done				Done					
FE Systems	Lionberger				Done	Done				Done	Done	Done	Done		

An order for the CHL and LINAC oxygen transmitters was placed this week after completion of a test program. These tests included using helium/oxygen gas mixtures to verify that the sensors correctly report oxygen levels in the presence of helium; testing with an extended interconnecting cable between the sensor and transmitter (to simulate actual installed conditions) and operation near the HVCM to ensure that EMI would not affect operation. This order completes all major procurements for the CHL ODH system (cable, PLC equipment, field devices - beacons and horns, and oxygen transmitters).

Fabrication is complete on the first of three stand alone ODH systems for the CHL. These systems will be used to provide ODH system coverage during commissioning. The first unit will be installed in the CHL cold box area to provide ODH coverage when the liquid nitrogen system is placed into service.

A network security audit of the PPS (suggested by the ARR committee) was completed this week. Several areas of potential attack were found and closed. One was a default setting in the vxWorks kernel that allows the network stack to route IP traffic between two connected networks, just like a router.

A linux-based "PV Server," intended to serve PVs for alarm summary and do calculations for display, was installed at the site this week. A "Timing Scope Application" was installed on this server to show operators the relationship between timing events. This had been an operator-requested action item based upon the Front End Commissioning run.

At BNL, Extraction Power Supply CPU loading was measured with nearly a full complement of oscilloscopes, and an EDM screen designed for monitoring the current in the SNS extraction kicker magnets. The full complement of 'scopes will support 28 waveforms, with 14 waveforms overlaid in each of two displays. For this test 20 1000-point waveforms were used, with 10 in each display. Each waveform was updated at 6 Hz. Total CPU loading was 25% with no EPICS clients, 35% with 1 20-waveform client, and 42% with 6 clients displaying a total of 40 waveforms. CPU loading with all 28 signals and 1 20-waveform client is expected to be less than 50%.

A Ring Systems Site Navigation Screen has been prepared and checked into the CVS repository. In response to operator action items following on the Front End run, the current status of the alarm handler configuration files was reviewed and approved by operations.

The controls group maintains a "scorecard" to track activities that must be completed before the DTL1 ARR. (See below.) This scorecard is statused once a week. This activity stimulated a division-wide meeting to encourage completion of test plans, etc, and to make sure that the various subsystem test plans incorporate their controls requirements. Much remains to be done, but many elements of the scorecard were completed this week. A plan for power supply testing is under development in a collaboration that includes the ORNL electrical group, the LANL power supply engineer and the SNS controls team.

During operation, the control system has been plagued by a number of problems – two of which are of particular concern. The first problem manifests itself as a temporary loss of communication (and hence data) between IOCs; the second as the loss of archived data, or possibly of the ability to retrieve archived data. A collaboration between LANL, BNL and ORNL is slowly making progress with these mysteries. The communication problem is associated with the depletion of an EPICS communication buffer resource known as MBUFs. At ORNL test code was added to the IOC real-time kernel to allow adjustments to the network stack at startup. Making use of this, it was discovered at BNL (while doing the oscilloscope tests described above) that a task that was "hogging" the CPU (because of a "bug") was causing other tasks to be "CPU starved." When those tasks were finally executed, the work backlog was dumped on to the network stack all at once causing the resource shortage. This was not clear until the MBUF pool was made huge (using the test code mentioned above) so that actual demand could be seen. The error code provided by the kernel had been misleading us. The bug was fixed, the other tasks were no longer CPU starved, the MBUF returned to normal and the communication problem went away. Not yet a complete solution for problems here, but a possible clue.

The archiver problem, at least in some instances, was related to a problem with the distribution of the time-of-day clock. Some IOCs had incorrect or nonsensical time-of-day information, and thus archived with incorrect or nonsensical time stamps, making the data irrecoverable. The time-of-day is distributed on the Real Time Data Link (RTDL) by the SNS timing system. Due to an incorrect IOC initialization procedure, these RTDL time stamps were not being used. The back-up time-of-day source is from a "Network Time Protocol (NTP)" server. This did not work in all cases because the NTP service was apparently down when the IOCs with the wrong time were booted up. A comedy of errors. Questions remain, but there has been progress here as well.

Installation

Craft Snapshot 5/7/03

ASD craft workers	84.0
Foremen, ES&H, etc	12.0
Less WBS 1.9 controls	8.0
Less absent	7.0
TOTAL	81.0

Accelerator Physics

Operations Group

Worked on OPM Documents for the ARR

Held an ARR Requirements Meeting

Processed DTL Tank 3 (with others)

Worked on integrating Diagnostics Cable data into the CMMS

Worked with MIS on the data structures for Equipment Tracking Data

Ion Source Group

The Hot Spare stand has been successfully restarted in the Front-end building. It was tested by extracting up to 34 mA from the ion source previously installed on the Front-end.

Paul Gibson returned from GSI and has retaken the lead in preparing the front end for the next re-commissioning period.

Tom Roseberry improved the LEBT valve under the guidance of the Vacuum group. It was reinstalled and tested for sealing. The He leak rate never exceeded 8×10^{-8} Torr-l/s, which does not significantly affect the base pressure in

the RFQ. The small leak is most likely caused by the sealing surface on the RFQ entrance flange that has been roughed by discharges and sputtering.

The refined Self-Consistent, Unbiased Elliptical Exclusion method of RMS-emittance analysis was presented orally at PAC 2003 in Portland, OR. After the talk CDs with the analysis code and a user manual were placed on a table in front of the audience. All 10 CDs disappeared within 15 seconds, evidence of high interest.

Survey and Alignment Group

S & A has completed the fiducialization of all drift tubes for DT Tank 1 including end walls. Data adjustment transformations were completed to allow for alignment.

We have completed the layout of over 500 anchor boltholes locations and magnet centers for components in the HEBT and Linac Dump. Most of the anchor boltholes have been installed and many component stands are already installed.

We have completed alignment analysis of our current Front End measuring campaign. This includes rebuilding a new local network. The net result is essentially that the FE and associated components are where they were reported in March. As a result, we are ready to start the realignment process. Alignment will start as soon as we are given a green light to proceed ahead (hopefully Monday 19 May).

DT Tank One alignment has begun and alignment is expected to continue for the next 5 - 6 days.

Prepared necessary for the layout of warm section stand bolt holes (approximately 800)

We established reference line to verify ring extraction dump after installation.

Prepared plan for setting target cart liner using the inner support cylinder as a reference.

Attended a number of meetings with Target Group to establish alignment guidelines.

Mechanical Group

Ring installation

- Installation of the HEBT tunnel cable tray has been completed through the achromat arc.
- Installation of the HEBT 12Q45 magnet DC cables has been completed down to position QV11.
- Received RING half-cell magnet assembly #9 and staged it in the HEBT tunnel.
- Moved Ring Half-cell magnet assemblies #7 & 8 into the RING tunnel and staged them along the outer tunnel walls adjacent to their respective arc locations.
- Installation of the HEBT 12Q45 support stands has been completed to the linac dump. Approximately 1/2 of the 12Q45 stands are now installed.
- Installation of the HEBT 8D533 Dipole stands has been completed through the achromat arc.
- The HEBT diagnostic chambers were received from BNL.
- The HEBT vacuum drift pipe and diagnostic chamber supports were received.



The big payoff for crane enthusiast from the seven-year of argument about tunnel cranes

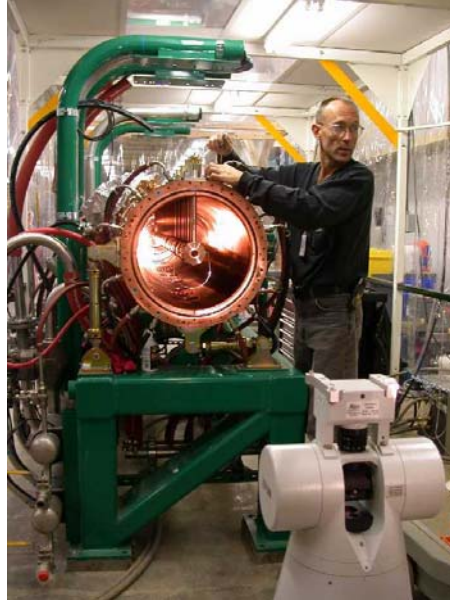
Water installation

- Installation of the piping to equipment in the RFTF has been completed.
- Flowmeters for the DTL manifold system were returned and the three missing ones were re-installed on D-Plate
- The purchase requisition for flowmeter spares was placed.
- Work on the D-Plate tunnel water system has been completed and the missing ferrules have been installed.
- Installation of the D-Plate compressed air system was started.
- Installation of the copper cooling lines on waveguides continues.

Installation of DTL 5 & 6 TRCC water systems continues.

The installation of the 59 DT's for DTL-1 was completed on May 13. No significant problems were encountered.

DT alignment began on May 14 and will be completed next week.



DTL-1 DT Alignment

Magnet Task

We have tested three CCL Quads.

We have received another SRF Quad and are testing it.

We have installed a few beam tubes into HEBT 12Q45's

We have completed the acceptance tests of all 15 HEBT correctors (12Q45), including 8 horizontal ones (SN001H - SN008H) and 7 vertical ones (SN001V - SN007V).

Electrical Group

Magnet cable pulls HEBT_MAG QV1 through HEBT_MAGQV6, 18 magnets in the straight section completed.

HEBT tray to the ground break 80% complete, and DH11 cable pull done.

Materials for cable tray installation delivered to RING support building.

Copper bus positioned in ring tunnel and set up for production started.

HPRF

Installed 402.5 klystron in DTL6 transmitter.

Calibrated forward power measurement for DTL3 & DTL1 and RFQ RF Systems.

DTL2 klystron was used to support HVCM testing up to 90kV.

Mounted three 550 kW klystrons in one 3-hole HV-tank as measure to conserve space in RF Test Facility. All klystrons will be stored in this fashion until we can move them into their assigned location in the Klystron Gallery. A mechanism is being developed to lift the klystron/magnet as an assembly by a forklift.

LLRF

Cryo Systems Group

CHL: Work continues on the installation of the instrument air, the LN2 transfer line and the purifier gas piping. The heaters for the charcoal bed have been rewired and the unit is on a heat cycle. Inclement weather is hampering the installation of the LN2 transferline.

Linac Tunnel: Work continues on the warm gas header, they are installing the "T"s in the cool down and vacuum lines on the east end of the gas headers. WE have connected 4 of the 8" pipes on the down stream return modules.

RATS: Work continues on the vacuum and cool down sub assemblies for the Linac warm gas header. We have completed the assembly of the transfer line actuators.

Beam Diagnostics